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Soil Survey
of
Orange County, Virginia

By

B. H. HENDRICKSON

Bureau of Chemistry and Soils

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SOIL SURVEY

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SOIL SURVEY OF ORANGE COUNTY, VIRGINIA

By B. H. HENDRICKSON

COUNTY SURVEYED

Orange County is in the north-central part of Virginia. Its geographical center is about 70 miles southwest of Washington, D. C., 28 miles west of Fredericksburg, Va., and 55 miles northwest of Richmond, Va. Rapidan River forms the northern boundary of the county, which is irregular in outline. Its greatest dimension, from northeast to southwest, is about 36 miles. Its north and south dimension ranges from approximately 7 miles in the extreme western part to 16 miles in the eastern. The land area of the county is 309 square miles, or 197,760 acres.

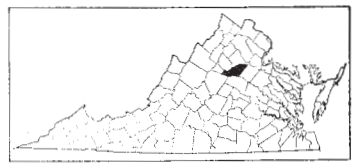

FIGURE 1.—Sketch map showing location of Orange County, Va.

Orange County, which is situated entirely within the piedmont plateau, consists of a well-dissected plain of rolling or hilly relief, crossed in a northeast-southwest direction by a low somewhat discontinuous mountain ridge which enters the county between Gordonsville and Barboursville and extends to the vicinity of Orange. This ridge is known as Southwest Mountain. Northeast of Orange is Clark Mountain. The higher points on the ridge, which are the highest in the county, reach elevations approximating 1,200 feet above sea level. Several isolated hills ranging in elevation from 600 to 900 feet and locally termed mountains lie in the western part of the county. Fully three-fourths of the county is rolling. With the exception of the mountains mentioned, the main divides and watershed ridges lie at an elevation between about 400 and 500 feet above sea level. The lowest land, lying at an elevation of about 200 feet, is in the extreme northeastern part of the county on Rapidan River. The higher mountains or ridges are underlain by intrusive dikes or masses of dark-colored igneous rock.

Orange County was formed from Spotsylvania County in 1734. In 1738, Augusta and Frederick Counties were formed from that part of Orange County lying north and west of the Blue Ridge. Culpeper County was formed from the northern part of Orange County in 1748, and Greene County was formed from the western part in 1838.

The first white settlers in Orange County were 12 families of Germans who, in 1714, settled at Germanna on Rapidan River, to operate iron mines and furnaces. The first English settlers arrived about 1724. Most of the present population is descended from the original Anglo-Saxon settlers who lived in the State of Virginia in

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pre-Revolutionary times. Descendants of negro slaves form the colored population. The entire population, given as 13,320 by the census of 1920, is classed as rural; the density is 37.1 persons to the square mile. The population is evenly distributed, except on Southwest and Clark Mountains and in the eastern part of the county from Rhoadesville eastward, in the territory surrounding Locustgrove, Wilderness, and Flatrun. The densest settlement is in the vicinity of the larger towns.

Orange, the county seat, Gordonsville, Barboursville, Somerset, Unionville, and Rhoadesville are the principal towns. Orange, Gordonsville, and Barboursville are located on main-line railroads and are the principal local markets and distributing centers.

The arable lands of the county are only partly cleared and in cultivation or pasture. There has been practical abandonment of the crop land to natural reforestation on many farms comprising the less productive soils, particularly in the hillier sections where erosion has been most serious. Considerable agricultural land is now in timber, and a large acreage of cleared land, now farmed, is of low productivity and is not being utilized profitably for crop production.

Orange County is well served with railroad transportation facilities, which provide easy access to the large outside markets of the eastern seaboard. In 1845 the Chesapeake & Ohio Railway reached Orange County at Gordonsville, and in 1855 the Southern Railway reached Orange. The Virginia Central Railway, which was built in 1875, has recently been widened to standard gauge. The Southern Railway enters the county near Barboursville. The Chesapeake & Ohio Railway, entering the county at Gordonsville, connects with the Southern at Orange. No point in Orange County is more than 15 miles from a railroad.

The main highways are good and generally well maintained, many being of tar-bound macadam construction. The principal county roads are graded and kept in fair condition. Most of the secondary roads, particularly in the hillier districts, are very rough. A rural telephone system serves the more prosperous farming sections.

The towns in the county serve as local markets for such garden truck as is raised for sale, some eggs and poultry, milk, butter, cream, and part of the beef, veal, pork, fruit, and grain. The principal farm products reaching outside markets are clover and timothy hay, wheat, corn, eggs, poultry, cream, creamery butter, beef cattle, veal calves, hogs, home-cured hams, and apples. Orange County is noted for its well-bred dairy cattle and thoroughbred saddle horses of the hunter type, a considerable number of which are shipped out of the county annually. The principal outside markets are near-by Virginia cities, Washington, Baltimore, Philadelphia, and New York.

CLIMATE

Orange County has a temperate humid climate, characterized by an average frost-free season of 192 days in the parts where most of the agricultural land occurs. On the high hills and mountains the frost-free season is two or three weeks shorter. Winters are usually cold but are reasonably short, with temperatures below zero rare and of brief duration. Summers are warm, with periods of hot weather. During spring and fall, when the weather is prevailingly mild, certain hardier crops such as small grain and pasture

and hay grasses continue to grow. The average date of the latest frost is April 13 and of the first is October 22. The latest and earliest frosts on record occurred on May 11 and October 2, respectively.

The mean annual precipitation of 43.43 inches is usually well distributed throughout the year, the summer season being the wettest and the fall the driest. Droughts of sufficient length to injure growing crops are not common. The average annual snowfall is 20.5 inches. Moisture is ample for tree growth, and mixed forests, rather than prairie, formed the original native vegetation.

The rainfall, temperatures, and length of growing season are such as to allow proper maturity of a large variety of crops, but the season is too short for such crops as cotton and sugarcane. Figs and pecans can be grown. Native fruits include wild strawberries, dewberries, blackberries, huckleberries, wild cherries, papaws, mulberries, and persimmons, and cultivated fruits are apples, pears, peaches, quinces, apricots, plums, grapes, and small fruits.

The climate is suitable for winter wheat and rye, hardy winter oats, red and crimson clover, and similar crops. The pasture season starts in early spring and lasts until late fall. Substantial barns and stables are needed to care for livestock properly, and silos are in general use to supply succulent feed during winter. A large part of the hay and forage crops which are cured as hay is stored for winter feed in barns.

Among the more outstanding effects of climate on soils may be mentioned freezing and thawing during winter and the thorough leaching by rain water, with the consequent loss of a large part of the organic matter which has accumulated from forest débris.

Table 1 gives the normal monthly, seasonal, and annual temperature and precipitation at Mayhurst (Orange), which is representative of the greater part of the county.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Mayhurst (Orange)*

[Elevation, 500 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1925)	Total amount for the wettest year (1906)	Snow, average depth
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
December	37.5	73	−3	3.36	2.46	2.90	4.2
January	35.9	76	−2	3.26	3.74	4.31	6.8
February	36.2	78	−15	2.81	1.17	1.23	5.0
Winter	36.5	78	−15	9.43	7.37	8.44	16.0
March	46.8	92	9	3.60	1.31	5.78	2.8
April	55.8	96	22	3.15	1.98	3.52	1.4
May	65.0	96	34	4.36	1.72	2.18	.0
Spring	55.9	96	9	11.11	5.01	11.48	4.2
June	72.5	99	45	5.01	2.47	4.95	.0
July	76.1	100	52	4.71	3.08	5.31	.0
August	74.6	102	50	4.71	1.77	10.82	.0
Summer	74.4	102	45	14.43	7.32	21.08	.0
September	69.2	100	35	3.23	2.79	3.35	.0
October	58.3	94	24	3.03	4.45	10.78	.0
November	47.5	86	14	2.20	3.04	2.27	.3
Fall	58.3	100	14	8.46	10.28	16.40	.3
Year	56.3	102	−15	43.43	29.98	57.40	20.5

SOIL SERIES AND TYPES

In this report the soils occurring in Orange County are identified, located, and described, the relation between the soils and the agriculture of the county is briefly explained, and some general statements in regard to the fertility of the soils, their fertilizer needs, and methods of maintaining or increasing their productivity are made. The reader who wishes to know all the details which have been worked out, experimentally, in regard to best utilization of the soils of the county is referred to the Virginia Agricultural Experiment Station at Blacksburg, Va., for further information.

Soils are differentiated and classified according to their profile characteristics and origin. Soils derived from the same kind of rock and having like or very similar profiles, except for surface texture, are included in one series and a series name is given them. The series is divided into soil types according to the texture of the surface soil. Certain important variations from type, caused by relief or erosion, are mapped as soil phases. In Orange County 22 soil types and 6 phases of types are mapped. The distribution of the soils is shown on the accompanying soil map, and their acreage and proportionate extent are given in Table 2.

TABLE 2.—*Acreage and proportionate extent of the soils mapped in Orange County, Va.*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Davidson clay loam	22,592	20.2	Penn clay loam	2,176	1.5
Hilly phase	17,408		Hilly phase	704	
Nason silt loam	58,432	32.9	Granville loam	1,856	1.4
Eroded phase	3,584		Stony phase	960	
Steep phase	2,880		Granville fine sandy loam	320	.2
Nason loam	7,744	3.9	Wadesboro loam	640	1.1
Nason sandy loam	2,816	1.4	Eroded phase	1,536	
Tatum silt loam	14,464	7.3	Lehigh silt loam	576	.3
Tatum clay loam	9,984	5.1	Worsham silt loam	1,472	.7
Tatum sandy loam	2,816	1.4	Altavista silt loam	256	.1
Tatum loam	11,072	5.6	Congaree loam	4,032	2.0
Iredell loam	8,192	4.1	Congaree silt loam	5,248	2.7
Orange silt loam	5,952	3.0	Wehadkee silt loam	1,664	.8
Montalto clay loam	4,864	2.5			
Penn silt loam	3,520	1.8	Total	197,760	

DAVIDSON CLAY LOAM

A thin covering of leaf mold and leaves lies on virgin Davidson clay loam, locally known as "red land." The surface soil consists of a 1 or 2 inch surface layer of deep-brown heavy loam or silt loam containing considerable organic matter, underlain to a depth ranging from 4 to 7 inches by dark-brown or reddish-brown clay loam or heavy silt loam. In most places the surface soil contains sufficient sand to give it a mellow and fairly friable consistence. In cultivated fields it ranges from deep reddish-brown to red in color. The subsoil, to a depth ranging from 30 to 40 inches, is deep-red or maroon-red clay of uniform texture. It has a smooth feel and breaks into angular particles ranging from less than a quarter inch to a half inch in diameter. In some places a few soft small manganese oxide concretions are present. Below this layer is a smooth clay layer of slightly less intense red color, containing a few black streaks and ocherous-yellow spots and splotches. The proportion of yellow

spots increases with depth and with increasing friability of the material. At a depth ranging from 6 to 8 feet, the parent diorite or trap rock is reached.

Davidson clay loam is a well-defined soil type, remarkably uniform in all its characteristics. Minor variations occur in the rock content, depth of weathering, intensity of color, surface relief, and surface texture. More resistant masses or bowlders of parent rock are seen in many places in road cuts in the weathered clay subsoil, and in a few places they outcrop. Between these masses of rock, however, the soil may be 8 or 10 feet deep. In some places the deep-red color of the upper part of the soil fades into paler red, particularly along the line of contact with Montalto soils. A few small scattered areas of Davidson loam, having a reddish-brown loam surface soil from 4 to 8 inches deep overlying typical Davidson clay loam material, were included in mapping. The largest area of this kind is 1½ miles east of Lahore.

Davidson clay loam, ranking second in extent among the soils of the county, is the most important agricultural soil. Most of it, together with its hilly phase, occurs in one large belt averaging about 5 miles in width and extending from the Albemarle County line near Gordonsville and Barboursville northeast to the northern county line. The largest areas are in the vicinity of Orange, Montpelier Station, Liberty Mills, and Somerset. A few small bodies occur elsewhere in the county.

The relief ranges from undulating to rolling, but a few small included areas are hilly. Most of the soil occurs as a broad foothill belt extending out from the bases of Southwest Mountain and Clark Mountain, which consist of the same kind of rock and soil material. The fairly smooth surface is cut by numerous small shallow drainage ways.

Drainage is good. The penetration of rainfall is also good, considering the percentage of clay in the surface soil, and the subsoil is very retentive of soil water. However, over much of the land the run-off is somewhat too rapid and erosion is active. Where a mulch is maintained on cultivated fields this is perhaps the most drought-resistant soil in the county. Farmers report that the soil, in wet springs, tends to be sticky, cloddy, and difficult to plow, especially where not limed.

The native vegetation consists of a heavy growth of mixed forest of deciduous trees such as tuliptree, yellow poplar, and basswood, white, red, black, and chestnut oaks, chestnut, locust, birch, maple, persimmon, hickory, and walnut, together with some juniper and shortleaf pine. The forest trees are noticeably larger and more vigorous, with more open spaces and less scrubby growth and underbrush, than on other upland soils of the county.

About 90 per cent of the Davidson clay loam is in cultivation. Farm buildings are of good size, as a rule, and many farms are equipped with silos, tractors, and modern machinery. Crops grown include corn (pl. 1, A), wheat, oats, red clover and timothy, alfalfa, soybeans, cowpeas, orchard fruits, chiefly apples, and bluegrass for pasture. In addition, many minor crops such as rye, potatoes, sweet-potatoes, peaches, pears, grapes, and a large variety of garden products are grown. Dairying on a large scale is carried on on some farms, and on a smaller scale, in connection with the raising of beef

cattle, hogs, and poultry, on most farms including this type of soil.

Corn yields from 30 to 50 bushels, wheat from 15 to 25 bushels, oats from 20 to 50 bushels, clover and timothy from 1 to 2 tons of hay, and alfalfa from 2 to 3 tons of hay to the acre.

Davidson clay loam is regarded as the best general-purpose soil not only in this county but in the piedmont plateau of Virginia. It is naturally strong and durable. It is suited to the production of corn, clover, small grains, alfalfa, and orchard fruits, and produces an excellent bluegrass sod which, when properly pastured, has remained in good condition when unbroken for 75 or more years. The soil can be built up to a high state of productivity by the addition of barnyard manure, green-manure crops, and moderate amounts of lime and fertilizers, and by deeper plowing.

Davidson clay loam is rather extensive in the piedmont region of Virginia, the Carolinas, and Georgia. In Georgia the soil is somewhat different in its characteristics from that in Virginia and North Carolina, but throughout the region of its occurrence it is known as the soil with a higher inherent productive capacity than any other soil within the region. No chemical analysis has yet been made of samples of this soil from Orange County, but Table 3 shows the composition of a sample from a vertical section of Davidson clay loam in Burke County, N. C.

TABLE 3.—*Chemical analysis of Davidson clay loam*

Sample No.	Depth	Constituent											
		SiO_2	TiO_2	Fe_2O_3	Al_2O_3	MnO	CaO	MgO	K_2O	Na_2O	P_2O_5	SO_3	Ignition loss
	Inches	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
237113	0 to 8	59.30	1.80	7.87	17.94	0.51	0.67	0.39	0.83	0.20	0.24	0.09	9.65
237114	8 to 50	48.33	1.80	12.49	24.90	.07	.30	.25	.51	.03	.16	.14	11.12
237115	50 to 80	47.24	1.44	11.57	26.96	.04	.10	.16	.36	.19	.20	.16	11.27
237116	80+	32.55	3.62	25.55	23.96	.30	.49	.10	.15	.07	.10	.20	13.73

Table 3 shows that the precentages of lime and potash in the surface soil are good. The proportion of these constituents is moderately high in comparison with the proportion in other soils of the Southern States but is not so high as in most of the soils of the Northern States. Virginia lies in an intermediate situation between the Northern States, where the soils are less leached of lime and potash, and the Southern States, where they are in general more extensively leached of these constituents.

The percentage of phosphoric acid is rather high, but crops on this soil, as on practically all soils in regions of heavy rainfall, will respond to the addition of readily soluble phosphorus. This soil can not, from the chemical point of view, be considered a rich soil like the black soils of the corn belt or the wheat belt of the Great Plains, yet it can not be called a poor soil. Its productive capacity is high for both grass and grain, in comparison with soils of the Southeastern States, and it compares favorably with any soil in the humid part of the United States outside the prairies of the corn belt.

The physical characteristics of this soil are as important in determining its productivity as its chemical characteristics. Table 4 gives the results of mechanical analyses of the samples whose chemical composition is shown in Table 3.

TABLE 4.—*Mechanical analysis of Davidson clay loam*[1]

Sample No.	Depth	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
	Inches	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
237113	0 to 8	4.3	11.6	7.9	10.2	4.5	19.1	42.4
237114	8 to 50	2.1	6.0	4.3	5.9	3.1	7.3	71.4
237115	50 to 80	3.5	7.1	5.0	7.3	4.6	25.6	46.7
237116	80+	8.2	19.5	9.1	11.5	9.1	27.7	15.1

[1] The diameter, in millimeters, of the various-sized texture particles is as follows: Fine gravel, 2 to 1; coarse sand, 1 to 0.5; medium sand, 0.5 to 0.25; fine sand, 0.25 to 0.1; very fine sand, 0.1 to 0.05; silt, 0.05 to 0.005; clay, less than 0.005.

The low percentage of sand and high percentage of silt and clay and the friability of the soil when carefully cultivated and kept supplied with organic matter cause its productivity of grass and grain. The characteristics mentioned, together with the granular structure, give the soil good water-holding capacity and allow the plant to utilize a large part of the moisture present.

Davidson clay loam, hilly phase.—Soil of this hilly phase, locally termed "mountain red land," is differentiated from typical Davidson clay loam principally on the basis of relief. The soil material is identical with that of the typical soil, but the depth to parent rock averages slightly less. In places rock fragments occur on the surface and through the soil. Many areas where these rocks outcrop are indicated on the map by rock-outcrop symbols.

This hilly soil includes nearly all the large, prominent, high ridges or mountains in the county, whose slopes, which are hilly rather than steep, are not suited to cultivation. In only a few places, on the higher elevations, are steep slopes to be seen. On account of its topographic position the land is susceptible to severe gullying and surface erosion by heavy rainfall. Erosion is more active than on typical Davidson clay loam and a larger proportion of the plowed fields shows the brighter-red clay subsoil exposed. There is little settlement, few roads and houses, and little cleared land in these large mountain areas. In places where typical Davidson clay loam and the hilly phase grade into one another, the line of demarcation is rather arbitrary.

Soil of this phase, though extensive, is of little agricultural importance. Almost all of it occurs in large areas on Southwest and Clark Mountains. Several smaller areas are near by.

Drainage is good. The native forest vegetation is of the same character as that on Davidson clay loam.

About 15 per cent of this land is in cultivation, mainly to corn, wheat, and hay and pasture grasses, all of which, as a rule, produce somewhat less than on Davidson clay loam largely because of the difficulty of maintaining a fertile topsoil where erosion is so active. Farms are smaller than on typical Davidson clay loam, and the general appearance of buildings and equipment indicates that farming is carried on with considerable difficulty.

Soil of this phase is best suited to soil-binding crops which require a minimum of plowing and cultivation, as alfalfa, clovers, other hay crops, and bluegrass pasture. The stonier areas are best suited to commercial forestry.

NASON SILT LOAM

The surface soil of Nason silt loam, in virgin areas, consists of a 1-inch layer of grayish-brown silt loam containing a small amount of organic matter, underlain to an average depth of 10 inches by light brownish-gray or grayish-yellow silt loam low in organic matter but friable and mellow. The upper subsoil layer, which continues to a depth ranging from 30 to 36 inches, is reddish-yellow or yellowish-red friable clay or silty clay. This material is somewhat stiff and brittle but crumbles fairly easily into a granular mass. In places streaks of yellow and red occur throughout this layer, which is underlain by mottled reddish-yellow, yellow, and light-red friable clay in places containing some disintegrated rock. At a depth ranging from 4 to 5 feet below the surface soft disintegrated schist or shaly rock is present.

In cultivated fields, the surface soil is brownish gray or light gray, depending on the amount of organic matter present. In spots where the clay comes near the surface a reddish-yellow tinge is noticeable. A few flaky fragments of the parent rock are scattered over the surface and considerable quartz gravel is present throughout the soil. Some of the more gravelly areas are shown on the soil map by gravel symbols.

Included with Nason silt loam in mapping are small areas of Tatum silt loam and small areas and narrow strips of Nason silt loam, eroded phase. The line of separation between Nason silt loam and Nason loam is arbitrary in places, owing to the fact that these soils grade one into the other over a considerable area.

Nason silt loam is by far the most extensive soil in Orange County. Although not so extensively cultivated as some of the more productive soils, it is of considerable agricultural importance. It occurs in large areas in all parts of the county, except the western part. A belt from 3 to 5 miles in width crosses the county from southwest to northeast, bordering the Davidson clay loam belt on the southeast.

Areas of Nason silt loam are generally undulating or rolling, but some near the larger streams are sharply rolling or hilly. Areas associated with Tatum silt loam are smoother than those occupying the knolls, ridges, and best-oxidized and best-drained positions.

Drainage is good, and in the more rolling areas erosion has been very active. The surface soil of areas which have at some time been cultivated has been more or less thinned or removed by erosion.

The native vegetation consists largely of white oak, with some red, black, post, and chestnut oak, hickory, dogwood, much scrubby growth of all the trees mentioned, considerable underbrush, and some juniper and pine. Most of the trees are about half as large as on Davidson clay loam.

About 20 per cent of this soil is in cultivation. Most of the farms are small but some large and well-equipped farms are located on or include fields of this soil. Dairying and other animal industries are carried on in a small way. The smoother or more undulating areas are only slightly subject to destructive washing. They are main-

tained in good productive condition by the use of lime, occasional manuring, and crop rotation. Under such treatment, this soil produces fair or good yields of a variety of crops.

Although not naturally productive, this soil is reasonably easy to cultivate, retains moisture well, and can be built up to a moderately productive state by the use of approved farming methods. A considerable proportion of the land should remain in timber and a large acreage can be utilized as pasture. The smoother-surfaced areas may be used for corn, small grains, hay, orchards, and leguminous forage and hay crops, as soybeans and cowpeas.

The results of chemical analyses of Nason silt loam are given in Table 5.

TABLE 5.—*Chemical analysis of a sample of Nason silt loam collected from a spot 6 miles southeast of Orange, Va.*

Sample No.	Depth	Constituent											
		SiO_2	TiO_2	Fe_2O_3	Al_2O_3	MnO	CaO	MgO	K_2O	Na_2O	P_2O_5	SO_3	Ignition loss
	Inches	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
35068	1 to 10	80.48	1.71	3.56	7.42	0.06	(1)	0.32	1.11	0.39	0.06	0.07	4.60
35069	10 to 30	57.65	1.45	9.96	19.67	.03	0.14	.57	2.95	.02	.13	.13	6.82
35970	30 to 40	47.35	1.44	12.76	24.81	.03	.20	.73	4.76	.02	.16	.13	7.46

[1] Trace.

A comparison of the surface soil of Nason silt loam with that of Davidson clay loam shows some striking differences. The proportion of lime in Nason silt loam is a very small fraction of that in Davidson clay loam; the proportion of phosphoric acid is about one-fourth as great, but the potash content is a third higher. The fact that the known productivity of the Nason soil is considerably less than that of the Davidson proves that the percentage of potash is not always a determining factor. A comparatively poor soil may have a high percentage of any one chemical constituent.

The most significant fact in the composition of Nason silt loam is the great difference between the percentages of iron and alumina in the surface soil and in the second layer. The surface layer has 3.56 per cent iron and the second layer 9.96 per cent. There is more than twice as much iron in the second as in the surface layer and two and one-half times as much alumina. In Davidson clay loam the differences are not so great by far, there being only about half as much more iron and about the same proportion of alumina in the second as in the surface layer, notwithstanding the fact that the percentages of both these constituents are higher than in Nason silt loam. The significance does not lie merely in the amounts present or in these differences, but in their meaning.

These differences have been brought about by the action of processes which have operated on these soils since they have been soils. They are the product of soil-developing processes operating in this region. Chief among these processes is leaching, brought about by the great amount of rain water that percolates through the soils. The materials leached from the surface soil, especially the iron and

alumina, are deposited in a deeper layer, thus depriving the surface soil of these constituents and enriching the subsoil. But it is the surface soil in which most though not all the plant roots lie. The extent to which plant roots feed on iron and alumina is not sufficiently great to warrant ranking these constituents as plant foods, yet their occurrence in the soil is an index of the extent to which leaching has operated. Leaching also removes other constituents, such as lime, potash, and often phosphoric acid, but these constituents are not deposited in a lower layer of the soil to any considerable extent, being mainly carried out into the rivers and streams of the region. As the lime is removed, the soil becomes acid in reaction. An acid soil is not so productive of many crops and especially of most of the legume crops as a soil that is not acid.

It follows, therefore, that a soil whose content of iron and alumina in the surface soil is much lower than in the second layer is usually acid to a greater or less extent. The extent of the difference in the proportion of these constituents in the soil layers mentioned is a rough measure of the degree of acidity. The degree of leaching is also indicated in the difference of color between the surface soil and subsoil. Where the surface soil is gray and the subsoil red or brown, removal of the iron from the first to the second layer has taken place, and where the surface soil is coarser or contains less clay than the subsoil the alumina has been removed from the first to the second layer.

Although the leaching process removes lime from the soil, at the same time lime is being brought up from the subsoil to the surface soil, and to the extent to which this takes place the rate at which the surface soil becomes acid is slowed up. The lime is brought up by plants, whose roots obtain it in the soil, often at considerable depth, and store it in their leaves and other tissues. When those leaves drop back to the soil the lime is also returned to it. The surface soil is enriched in lime, therefore, and if this enrichment is sufficient to counteract entirely the removal of lime from the soil by leaching, the surface soil will not become acid though the lower layers may. This process, however, is not usually able to overcome the effect of leaching, even in the surface soil, but in virgin soil the surface layer is in most places less acid than that 2 or 3 inches below the surface.

This process of enrichment in lime has been operating in all the soils of Orange County. All the soils are acid, but not equally acid, and a thin layer on the surface of the virgin soils is less acid than the layers below, except in Nason silt loam. The pH value of the surface layer of Nason silt loam has not been accurately determined, but field tests showed it to be greater than that of the soil just below the surface.

Growing grass tends to retard the removal of lime from the surface soil more than forest trees. This is because such a large mass of grass roots accumulate in the surface soil. Other farm crops act in the same way to varying degrees but usually more effectively than trees. The removal of the crop rather than its return to the soil overcomes its good effects in this direction.

The low natural productivity of Nason silt loam is owing more to the leaching of the surface soil with consequent acidity and to the

rather unfavorable structure of its surface soil and subsoil than to its chemical composition.

No sample of Nason silt loam has yet been analyzed for the purpose of determining the minor details of its mechanical composition. The field determinations are accurate within narrow limits. The soil is a silt loam with about 30 per cent of silt and 20 per cent of clay in the surface soil and about 10 and 70 per cent, respectively, of silt and clay in the subsoil. This statement is based on a comparison of the relative mechanical and chemical composition of a Tatum soil from the same region with the chemical composition of Nason silt loam.

Nason silt loam, eroded phase.—Nason silt loam, eroded phase, consists of badly sheet-eroded Nason silt loam and other closely associated soils of minor extent. Under cultivation, the loose silty or loamy surface soil of rolling fields has been largely washed away and traces of the remaining soil have been so intermixed with the subsoil clay as to produce a clay loam surface soil. A concentration of surface gravel, coincident with surface soil removal, is most noticeable on ridges, spurs, and upper slopes.

Soil of this phase is rather extensive near the larger streams in the northeastern part of the county, occurring in close association with Nason silt loam. The relief is rolling, sharply rolling, or hilly, and drainage is good. Many abandoned fields are growing up in wild pasture and forest.

About 20 per cent of this land is in cultivation, principally to corn, cowpeas, and soybeans. Yields are low. Very little of the land is farmed with a view to keeping up the productivity. It is perhaps the poorest land, with the exception of steep areas, in the county.

The condition of this soil was brought about by careless handling of strongly sloping easily eroded farm land which, in its virgin condition, was not very productive. The best utilization of such land is for pasture and reforestation.

Nason silt loam, steep phase.—In some places, the light-colored surface soil of Nason silt loam has been largely removed as fast as it is formed. In both wooded areas and open pasture the texture of the reddish-yellow surface soil ranges from silt loam to clay loam. The soil resembles typical Nason silt loam, except that practically unweathered bedrock, the parent material, occurs at a depth ranging from 1½ to 2 feet from the surface. Considerable quartz gravel lies on the surface, and outcrops of schist and shaly schist are common, causing the surface to be shaly in places. Included in mapping are small areas of all the shallow, steep, reddish or yellowish soils that are derived from schists and shaly schists.

Soil of this phase occurs in narrow strips bordering some of the larger creeeks, among which are Negro, Mountain, and Cooks Mill Runs in the southern part of the county. Smaller areas are mapped elsewhere, as near Indiantown.

This land, as its name implies, is so very hilly and steep that cultivation is out of the question on practically all areas. Drainage is excessive. Little opportunity for absorption of rainfall is afforded, as the run-off is so rapid. Sheet erosion is more active on this than on other soils of the county.

This land is not cultivated, but about 10 per cent is cleared and included in pastures. It can be utilized only for pasture and forestry.

NASON LOAM

This soil is one of the so-called "gray lands." In cultivated fields the surface soil is grayish-brown or reddish-brown loam 10 or 12 inches deep which, when dry, appears gray. Eroded gall spots of the exposed reddish-yellow clay subsoil are noticeable. The subsoil is rather stiff but brittle and fairly friable. Between depths of 30 inches and 4 or 5 feet the clay lower subsoil layer commonly becomes blotched with coarse mottles of red and yellow. The parent rock below this is schist. Included in mapping are small areas of Tatum loam, Tatum clay loam, and Nason silt loam.

This is a fairly extensive soil and ranks about equally with Tatum loam in agricultural importance. It occurs in several large areas in the central-eastern part of the county, in association with Tatum loam and Nason silt loam.

Areas are rolling or sharply rolling, and drainage is good. Erosion is serious on the more sloping fields, and the surface soil is so thin in many places that the subsoil is turned up by the plow.

The native vegetation consists of a good growth of mixed forest, including white, red, chestnut, and post oaks, hickory, dogwood, considerable underbrush, and some juniper and pine.

About 50 per cent of this soil is in cultivation. Most of the farms are noticeably better than on Nason silt loam and a much larger proportion of them is in cultivation. The principal crops are corn, wheat, oats, clover and timothy hay, soybeans, cowpeas, orchard fruits, and pastures. Corn yields from 25 to 40 bushels, wheat from 10 to 20 bushels, and clover and timothy from 1 to 2 tons of hay to the acre.

Nason loam is considered a good general-farming soil well suited to diversified farming. Protection of the surface soils against washing is the chief problem in its management. It is a more productive soil than Nason silt loam, mainly because of its better structure and somewhat better subsoil drainage.

NASON SANDY LOAM

This soil is locally termed "granite land." In cultivated fields, the surface soil to a depth of 12 inches is grayish-brown sandy loam which appears gray when dry. Small eroded spots and gall spots of yellowish clay or sandy clay are common. The subsoil, to a depth of 30 inches, is reddish-yellow clay. This grades through coarse mottled red and yellow clay into rotten rock about 6 feet below the surface. The parent rock of granite occurs at an average depth of 15 feet. Small areas of Tatum sandy loam and Tatum clay loam are the principal inclusions in mapping. Areas having many outcrops or surface bowlders of granite are shown on the map by rock-outcrop symbols.

This soil is inextensive and of only local agricultural importance. It occurs only in the southern part of the county in association with Tatum sandy loam, and in an area near Locustgrove where it blends with areas of Orange silt loam as the granite rock gradually changes to basic rock.

Nason sandy loam is characteristically rolling or hilly, and drainage is good. The surface soil absorbs rainfall rapidly and the clay subsoil retains it well. Like Tatum sandy loam this soil is to some

extent self-mulching. As on that soil, also, erosion is very destructive to the sandy surface soil.

The native vegetation consists of a mixed growth of forest trees including white, red, and post oaks, walnut, sycamore, hickory, juniper, and some pine.

About 75 per cent of the land is in cultivation. The principal crops are corn, wheat, soybeans, cowpeas, clover, orchard fruits, and potatoes. Corn yields from 30 to 50 bushels, wheat from 10 to 25 bushels, and clover from 1 to 2 tons to the acre.

This is considered a good general-purpose soil and is easily tilled.

TATUM SILT LOAM

The surface soil of Tatum silt loam, locally called "gray land," in wooded areas consists of a 1 or 2 inch layer of dark grayish-brown silt loam containing some organic matter, grading into friable light-brown or grayish-yellow silt loam 8 or 9 inches thick. This material has a floury feel. The subsoil, which extends to a depth ranging from 30 to 40 inches, is stiff but brittle bright-red clay or silty clay which breaks into irregular-shaped lumps and finally into a granular mass. When wet it is slightly plastic but when dry is hard and brittle. Below it the clay becomes slightly more friable and is also slightly streaked with yellow. At a depth between 5 and 6 feet the partly decomposed gray schist rock blotched and streaked with yellow and light red is reached.

In cultivated fields the surface soil is grayish brown, in places grayish yellow, and in a few places reddish brown. These various colors are caused by differences in the amount of organic matter present and also by the nearness of the subsoil to the surface. In numerous strips and narrow areas on upper slopes and ridges the clay subsoil is exposed. Included with mapped areas are several small areas of Tatum loam, Tatum clay loam, Nason loam, and Nason silt loam.

This is one of the more extensive soils of the county, ranking third in area, and is not of considerable agricultural importance. It is scattered throughout the county in many large areas except in the "red-land" district of Davidson soils. The largest area is near Daniel in the southeast part of the county.

Areas of this soil are, in general, undulating or rolling, but some are sharply rolling or hilly. Drainage is good, and on the more rolling areas erosion has been so active that cultivated fields once covered with a silt loam surface soil of normal depth have now a clay loam texture.

The native vegetation consists largely of white oak, with some red, black, post, and chestnut oaks, hickory, and dogwood, considerable scrubby growth of all the trees mentioned, and some juniper and pine.

About 40 per cent of the soil is in cultivation. Some dairying is carried on. The principal crops are corn, wheat, oats, clover and timothy hay, soybeans, cowpeas, orchard fruits, and tame grasses for pasture. Corn yields from 20 to 40 bushels, wheat from 10 to 20 bushels, oats from 20 to 30 bushels, and clover and timothy from 1 to 2 tons of hay to the acre.

This is a fair general-purpose soil. The character of the surface soil and subsoil is such that the land is fairly easy to cultivate, retains moisture well, and is capable of much improvement by good farming methods.

The chemical composition of Tatum silt loam is shown in Table 6.

TABLE 6.—*Chemical analysis of Tatum silt loam*

Sample No.	Depth	Constituent											
		SiO_2	TiO_2	Fe_2O_3	Al_2O_3	MnO	CaO	MgO	K_2O	Na_2O	P_2O_5	SO_3	Ignition loss
	Inches	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
35071	1 to 10	81.09	1.43	4.03	7.38	0.06	0.20	0.26	1.28	0.03	0.06	0.11	4.03
35072	10 to 30	63.57	1.30	9.06	18.04	.04	.10	.40	1.40	.08	.07	.12	6.70
35073	30 to 40	45.95	1.06	14.19	25.97	.04	.26	.47	2.10	.09	.10	.08	9.20

It will be noted that Tatum silt loam is almost exactly identical in chemical composition to Nason silt loam, the principal difference being in its higher content of lime. In comparison with Davidson clay loam, Tatum silt loam is low in lime. The leaching of lime and alumina from the surface layer has gone on to such an extent that the relative percentages are almost exactly the same as in Nason silt loam. The leaching of potash, lime, and phosphoric acid is indicated by the higher percentages of these constituents in the deep subsoil (between depths of 30 and 40 inches). An analysis of the rock from which the soils were derived would show that the extent of leaching of these constituents has been greater than is indicated and that iron and alumina have actually accumulated in all the soil layers except the surface.

The natural productivity of this soil is a little higher than that of Nason silt loam, owing mainly to somewhat better subsoil drainage.

TATUM CLAY LOAM

The surface layer of Tatum clay loam, locally called "red granite land," consists of reddish-brown or red clay loam from 5 to 8 inches thick. This is underlain by red stiff but friable clay which continues to a depth ranging from 30 to 40 inches, where it gives way to lighter-colored and more friable clay which grades, at a depth between 6 and 15 feet, into the disintegrated parent rock of schist, gneiss, and granite. In many places a thin covering of brown or grayish-brown sandy loam lies over the red clay loam. In other places included strips are Tatum and Nason soils from which the covering of silt loam has been removed, exposing silty clay loam. Owing to the forces of sheet erosion and gullying, both surface soil and subsoil have been greatly changed in texture and structure. In a few places quartz gravel is thickly scattered over the surface, particularly on some of the narrow ridge tops and upper slopes.

Tatum clay loam occurs in several large areas in the southern and extreme western parts of the county, principally in close association with Tatum sandy loam and Tatum loam. Areas are rolling, strongly rolling, or hilly. On many of the steeper slopes erosion has re-

moved the light-textured material. Surface drainage is good or excessive, and internal drainage is fairly good. The run-off of rain water is very rapid, and this causes considerable gullying and erosion.

Perhaps 40 per cent of the Tatum clay loam is under cultivation. Some of the land has been abandoned recently and has grown up mainly to scrub oak and pine.

The principal crops are corn, wheat, and clover and timothy hay, and some soybeans, cowpeas, and pasture grasses are grown. Except where this soil has been improved and properly cultivated, crop yields are low. However, on some good farms, which include properly handled areas of this soil, satisfactory yields have been obtained.

This is naturally a strong soil and one that can be made productive by deeper plowing and the addition of large quantities of organic matter either in the form of barnyard manure or green cover crops. Terracing is essential on the steeper slopes. Liberal applications of lime would also be beneficial. The soil is not so easy to cultivate as the sandy loams and loams, and stronger work animals and heavier implements are required to obtain the best results. It is well suited to clovers and grasses and some of the more sloping areas should be kept in pasture. The extremely eroded areas should be reforested.

TATUM SANDY LOAM

The surface layer of Tatum sandy loam, locally termed "sandy granite land," in its virgin condition consists of about 1 inch of dark-brown or dark-gray sandy loam containing a small proportion of organic matter. This is underlain to a depth of 10 or 12 inches by mellow friable gray or grayish-yellow sandy loam. The red clay subsoil is stiff but brittle and contains a noticeable quantity of quartz sand and a few mica flakes. At a depth ranging from about 3 to 4 feet this clay becomes light red or reddish yellow and is more friable. At a depth of about 6 feet it grades into soft grayish disintegrated granite which rests on solid granite bedrock at a depth of about 15 feet. A few quartz gravel and small rock fragments, together with large outcrops of the parent rock, occur locally. Where the sandy surface soil has been removed through erosion, red clay or clay loam is exposed, giving the fields a somewhat spotted appearance. Small areas of Tatum loam, Tatum clay loam, and Nason sandy loam were included in mapping.

Although this is a comparatively inextensive soil, it is of considerable agricultural importance. It occurs in the southern part of the county near North Anna River and lower Pamunky Creek, in small areas throughout the rolling uplands. Several small areas are in the extreme western part.

Tatum sandy loam is characteristically rolling but a small proportion is hilly. Drainage is good. The surface soil absorbs rainfall rapidly and the clay subsoil is very retentive of moisture. To some extent this soil is self-mulching and is drought resistant. The run-off is rather rapid during heavy rains. Erosion has been so destructive that large areas which at one time consisted of this soil are now Tatum clay loam.

The native vegetation consists of a mixed forest growth including white, chestnut, and post oaks, hickory, walnut, pine, juniper, and other trees.

About 75 per cent of the land is in cultivation. Many of the better-class farms are on it. The principal crops are corn, wheat, soybeans, cowpeas, clover, orchard fruits, potatoes, and miscellaneous vegetables and small fruits. Corn yields from 25 to 50 bushels, wheat from 15 to 25 bushels, and clover from 1 to 2 tons to the acre.

Tatum sandy loam is considered a good strong general-purpose soil, productive if carefully managed and suited principally to corn, small grains, and tobacco. It is one of the easiest soils in the county to cultivate and is ideal for early truck crops.

TATUM LOAM

Tatum loam is locally termed "granite land" or "gray land." In cultivated fields the 10 or 12 inch surface soil is grayish-brown loam, reddish-brown or red in "clay-gall" spots where the texture is clay loam or clay. The subsoil is stiff but brittle red clay to a depth of about 30 inches. Below this depth it gives way to more friable clay, somewhat blotched with coarse mottles of red and yellow. This layer rests on the parent rock of schist at a depth of 4 or 5 feet.

This is a fairly extensive soil in Orange County and is rather important agriculturally. It occurs in several large areas in the southern part of the county in the vicinity of Monrovia, Lahore, Tatum, and Vulcan. The largest areas are in the extreme western part of the county.

The relief is generally rolling, but some small areas are hilly. Drainage is good. After heavy rains the run-off is rapid, and erosion is serious on the more sloping fields. Badly eroded areas, at one time consisting of this soil, are mapped as Tatum clay loam on account of the washing off of the loam surface soil. The native vegetation is the same as that on Tatum silt loam.

About 75 per cent of this soil is in cultivation. Considerable areas, particularly in the western part of the county, have not been maintained in a good state of cultivation and are not so productive as areas in the southern part, where numerous excellent farms, with substantial buildings and equipment, are to be seen.

The principal crops are corn, wheat, oats, clover and timothy hay, soybeans, cowpeas, potatoes, orchard fruits, and tame pasture grasses. Corn yields from 25 to 50 bushels, wheat from 15 to 25 bushels, oats from 20 to 40 bushels, and timothy and clover hay from 1 to 2 tons to the acre. Some dairying is carried on.

Tatum loam is considered a good general-farming soil, well suited to the many crops grown in this section of the country. Its chief handicap lies in the difficulty of preventing erosion on the more rolling fields.

The results of chemical analyses of samples of Tatum loam collected 1 mile east of Scuffletown are shown in Table 7.

A, Typical corn harvest on Davidson clay loam; B, Congaree silt loam landscape with Nason silt loam in background

TABLE 7.—*Chemical analysis of Tatum loam*

Sample No.	Depth	Constituent											
		SiO_2	TiO_2	Fe_2O_3	Al_2O_3	MnO	CaO	MgO	K_2O	Na_2O	P_2O_5	SO_3	Ignition loss
	Inches	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
35074	2 to 8	81.96	1.10	2.67	6.62	0.03	0.24	0.30	1.20	0.02	0.09	0.09	5.48
35075	12 to 30	50.36	1.21	12.82	23.61	.03	.16	.37	1.13	.08	.14	.10	9.50
35076	36 to 72	64.14	.90	7.27	17.69	.04	.14	.75	2.32	.02	.10	.07	6.53

Table 8 shows the results of mechanical analyses of a sample of Tatum loam collected at the Vulcan post office, Orange County.

TABLE 8.—*Mechanical analysis of Tatum loam*[1]

Sample No.	Depth	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
	Inches	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
211879	0 to 10	1.8	3.9	4.2	20.9	15.5	31.5	22.2
211880	10 to 30	.3	1.4	1.5	8.4	7.4	12.2	69.0
211881	30+	1.9	5.7	4.5	15.4	10.9	15.6	46.1

[1] The diameter, in millimeters, of the various-sized texture particles is as follows: Fine gravel, 2 to 1 coarse sand, 1 to 0.5; medium sand, 0.5 to 0.25; fine sand, 0.25 to 0.1; very fine sand, 0.1 to 0.05; silt, 0.05 to 0.005; clay, less than 0.005.

The chemical composition of this soil is, in general, like that of Tatum silt loam. The relative percentages of all the constituents, especially of the silica, alumina, and iron, are alike in the two soils, that of the last two mentioned being low in the surface soil and high in the upper part of the subsoil, whereas the opposite relationship is true of the first. The surface soil has been leached of iron and alumina, which leaching always signifies that this layer has become more or less acid. Where the differences are as great as in Tatum loam it can only mean that the acidity is strong. The surface layer of the virgin soil, however, is much less acid than the subsoil because of the action of plants in bringing lime to the surface.

This relationship of the two layers is shown in their pH values. That of the surface layer is 6.4 and of the subsoil, or the layer extending from 10 to 30 inches, is 4.83. As a pH value of 7 signifies neutrality in reaction, it is clear that the surface layer is nearly neutral whereas the subsoil is strongly acid. Mechanical analyses of Tatum loam show that the percentages of sand and silt are high in the surface layer and low in the layer between depths of 10 and 30 inches, whereas the clay in the surface layer is low and in the underlying layer three times as great. This is merely another way of expressing what is indicated by Table 7, which shows the much higher percentage of alumina in the subsoil layer than in the surface layer.

IREDELL LOAM

The surface layer of Iredell loam, locally called "blackjack land," in its virgin condition consists of a 1 or 2 inch layer of dark-gray

loam containing considerable organic matter. Below this is brownish-gray or grayish-yellow loam which continues to a depth of 6 or 8 inches. The subsoil to a depth ranging from 20 to 24 inches consists of brownish-yellow plastic impervious clay, which is very hard when dry and extremely sticky when wet. Where exposed this material assumes a rust-brown color and cracks into small angular blocks. This clay layer is underlain by a 3 or 4 inch layer of brownish-yellow disintegrated diorite or basic rock which grades into hard rock.

In cultivated fields the surface soil is dark-gray or gray loam. In places it has been washed off, exposing the heavy clay subsoil. Included in mapping are very small areas of Davidson loam, Montalto loam, and Tatum clay loam. Some included small basin-like flatter areas have a typical Iredell profile but poor surface drainage. A considerable proportion of the soil included in Iredell loam consists of Iredell silt loam which was not separated on account of its small extent.

Although this soil is rather inextensive, it has local agricultural importance. The largest areas are in the southern part of the county near Lahore. Smaller areas occur throughout the county in association with soils derived from dark-colored igneous rocks.

The land, in general, is undulating or gently rolling but includes some flatter areas. Surface drainage is fair or good, except in the flatter areas. Internal drainage is markedly poor. The native vegetation consists mainly of blackjack, white, and red oaks, and hickory.

About 60 per cent of the Iredell loam is in cultivation. A number of substantial farms are located entirely on this soil or include fields of it, especially in the vicinity of Lahore. Dairying is important, and beef cattle and hogs are raised. The principal crop is tame-grass pasturage. Corn, clover, soybeans, cowpeas, and some wheat are grown, with good results in good seasons where the soil is limed and the wetter places drained by ditching. In wet seasons crops do not do so well.

Iredell loam seems best suited to hay crops and pasturage, as numerous grasses thrive on it. It is a moist soil, with a dense plastic clay subsoil and is suited to shallow-rooted crops. It is naturally strong and productive when its chief handicap, sluggish internal drainage, is to some extent offset by artificial drainage. Areas in which the clay subsoil is turned up by the plow or exposed on the surface are difficult to handle and should be kept in pasture.

ORANGE SILT LOAM

The surface soil of Orange silt loam consists of a surface layer, 1 or 2 inches thick, of gray silt loam underlain by light-gray or grayish-yellow silt loam which extends to a depth ranging from about 6 to 10 inches. The material has a smooth and floury feel and when dry is almost white. The subsoil of yellow or pale-yellow friable silty clay or clay continues to a depth ranging from about 16 to 24 inches. Below this is a layer of brownish-yellow heavy plastic clay similar in all characteristics to the subsoil of Iredell loam. This layer commonly ranges from about 3 to 6 inches in thickness and grades into disintegrated or hard light-colored basic rock. In cultivated fields the surface soil ranges from gray to very light gray

or almost white, depending on the proportion of organic matter present.

This is an inextensive soil and is of little agricultural importance. It occurs principally in one long area of variable width, in the eastern part of the county. The relief is nearly flat, undulating, or gently rolling. Surface drainage is fair or good, and internal drainage is poor.

The native vegetation resembles that growing on Iredell loam, consisting of blackjack, red, white, and post oaks, a few hickory and walnut, dogwood, and some juniper and pine.

About 10 per cent of the land is in cultivation, mainly to corn, soybeans, and cowpeas, which produce fair yields. Most of the cleared areas are in grassland.

The utilization of this soil is the same as Iredell loam, but the land seems to be somewhat less productive. It is in need of artificial drainage, liming, and manuring to obtain satisfactory crop yields.

MONTALTO CLAY LOAM

Montalto clay loam is called "pale-red land" in order to differentiate it from the red Davidson clay loam. The surface soil, to a depth of about 5 or 7 inches, is brown or faintly reddish-brown clay loam which dries out to grayish brown. In forested areas considerable organic matter occurs in the surface 1 or 2 inch layer. The subsoil is yellowish-red or yellowish-brown clay which is moderately friable when moist. Specks of ocherous-yellow material appear throughout this layer, which grades at a depth ranging from about 30 to 36 inches into pale-red or reddish-yellow clay containing decided blotches or streaks of ocherous yellow. In places the disintegrated or solid rock is reached. At a depth between about 5 and 6 feet the subsoil grades into the yellow rotten rock and clay material, which is streaked with yellowish red and streaked or specked with black. Below this, at varying depths, is diabase or diorite from which the soil is derived.

Included with this soil in mapping are a few areas of Montalto loam which has retained its loamy surface soil under cultivation. Most of these included areas, the largest of which is 2 miles west of Orange, have an undulating surface and have not been so subject to erosion as most of the Montalto clay loam. A hilly area of Montalto clay loam about one-fourth square mile in extent and lying 1½ miles east of Old Somerset has also been included.

Montalto clay loam is inextensive in Orange County and is of only local agricultural importance. The principal areas are near Old Somerset and Montpelier Station, and smaller areas occur elsewhere throughout the county.

Land of this kind is generally undulating or rolling, but some of it is hilly. The soil is well drained throughout, and erosion is a serious problem on most areas. The larger part of the soil was undoubtedly at one time Montalto loam.

The native vegetation consists of a good growth of tuliptree, white, red, and black oaks, hickory, walnut, locust, dogwood, and some juniper and pine.

About 75 per cent of the land is in cultivation, mainly to corn, wheat, oats, clover and timothy, orchard fruits, and bluegrass for

pasture. Corn yields from 25 to 40 bushels, wheat from 10 to 20 bushels, and clover and timothy from 1 to 2 tons of hay to the acre.

There are many substantial farms on this soil. Dairying is an important industry. The soil is regarded as strong and productive and where well managed and in a good state of productivity is almost as valuable as Davidson clay loam.

PENN SILT LOAM

The surface soil of Penn silt loam consists of mellow friable purplish-brown or brown silt loam, about 8 or 10 inches thick. In forested areas the first inch or two is darker colored, owing to the presence of considerable organic matter. The subsoil is purplish-red or Indian-red, friable, brittle, easily crumbled clay or clay loam which continues to a depth ranging from about 28 to 36 inches. Below this is purplish-red shale and interbedded sandstone, which is more or less tilted. In places small shale fragments and some sandstone are present on the surface and throughout the soil.

Included with Penn silt loam are a few flat areas in which the surface soil is loam, the upper part of the subsoil yellow clay, and the lower subsoil layer mottled yellow and gray material. Such areas are Lansdale loam but are of insufficient extent to be separated on a small-scale map. The largest is one-half mile west of Weyburn. In the belt of country between the Southern Railway and Hardwicks Mountain, the surface texture of included areas on knolls is loam or sandy loam.

Penn silt loam is of only local agricultural importance. It occurs principally between Barboursville and Weyburn, in Blue Run Valley in the southwest part of the county.

Penn silt loam is in general undulating or rolling, but a few sharply rolling areas are included. Drainage is good, except in included areas of Lansdale loam, where internal drainage is sluggish.

Erosion is serious on all sloping fields, and the surface soil averages rather thin on the older cleared lands.

The native vegetation includes white, red, post, and chestnut oaks, hickory, walnut, locust, and some juniper and pine.

About 75 per cent of the land is in cultivation. Many good farms, on some of which dairying is carried on, are located on it. The principal crops are corn, wheat, oats, soybeans, cowpeas, clover and timothy hay, orchard fruits, and pasture grasses. Corn yields from 25 to 40 bushels, wheat from 10 to 20 bushels, and clover and timothy hay from 1 to 2 tons to the acre.

This is a good general-purpose soil. It is of fair natural fertility and is considered the best among the shale and sandstone soils. Its chief handicap is its susceptibility to erosion.

PENN CLAY LOAM

Penn clay loam resembles Penn silt loam in color. The surface soil, under virgin conditions, is silt loam or heavy loam from 4 to 7 inches thick. This layer has been either largely washed away or incorporated with the clay subsoil, through plowing, to such an extent that the prevailing texture of the surface soil is now clay loam. The subsoil extends to a depth ranging from 3½ to 4½ feet and in most places is bright red or Indian red in color. In

typical areas the parent rock is purplish-red sandstone or diabasic conglomerate.

This is an inextensive soil, areas occurring chiefly near Montpelier Station, Old Somerset, and northeast of Raccoon Bridge. About 75 per cent of the land is under cultivation. Its agricultural value is about the same as that of Montalto clay loam.

Penn clay loam, hilly phase.—Penn clay loam, hilly phase, differs from typical Penn clay loam in that it occupies hilly, rough, and broken areas, which are so badly gullied and eroded that very little of the land is suitable for general-farming purposes. The surface soil and subsoil materials are practically the same in color, texture, and structure as in Penn clay loam, except that on some of the steeper slopes practically all the surface material has been washed off, exposing the purplish-red clay subsoil. In some places, however, the shale rock comes near the surface or even outcrops.

This soil occurs in one area in the extreme northern part of the county along Rapidan River, north of True Blue School. Its best utilization is for pasture and forest. Under cultivation, unless given proper terracing and extreme care in handling, erosion will practically ruin it.

GRANVILLE LOAM

The surface soil of Granville loam, locally called "gray land," is brownish-gray or grayish-yellow loam from 8 to 12 inches thick. It is friable and mellow and contains only a small amount of organic matter except in the first inch or two in wooded areas. The subsoil, which extends to a depth of about 24 or in places of as much as 30 inches, is very friable and crumbly yellow or pale-yellow clay, in places slightly mottled with yellow and light gray. Between depths of 30 inches and 4 feet this mottling is especially noticeable in the yellowish clay lower subsoil layer. The subsoil material grades into pale-yellow and gray friable clay splotched and mottled with some iron stains and containing fragments of shale and sandstone. In a few places this layer is heavier than the typical subsoil. Bedrock lies 4 or 5 feet below the surface. A few shale and sandstone fragments are scattered over the surface and occur in places throughout the soil. Locally the texture of the surface soil is silt loam or fine sandy loam. The largest body of silt loam occurs 1 mile northeast of Gordonsville.

This soil, which is inextensive, is of but local agricultural importance. It occurs in the western part of the county, mainly in one body northwest of Barboursville. The relief is undulating or rolling, and natural drainage is good. The native vegetation consists of white, black, post, and chestnut oaks, hickory, dogwood, and some pine.

About 50 per cent of the land is in cultivation, chiefly to corn, wheat, soybeans, cowpeas, and hay crops. Crop yields are fair. The soil, although not naturally very productive, responds well to liming, manuring, crop rotation, and moderate fertilization.

Granville loam, stony phase.—This stony soil very closely resembles typical Granville loam, except that the surface soil and subsoil are stony and gravelly, with assorted fragments of sandstone and shale. In these stony areas bedrock commonly occurs from 1 to 3 feet below the surface.

Land of this kind is hilly, the principal area occupying a part of Hardwicks Mountain. It is largely forested by a stunted growth of white and post oaks. It is unsuited to any agricultural purpose except forestry.

GRANVILLE FINE SANDY LOAM

Granville fine sandy loam, which is of very small extent, has a grayish-yellow fine sandy loam surface soil 12 or 15 inches deep and a yellow clay subsoil, somewhat mottled yellow and gray in the lower part, resting at a depth of 4 or 5 feet on soft gray sandstone. It occurs in one area, 1 mile west of Barboursville. Only a very small proportion of the land is in cultivation. The forest growth is the same as that on Granville loam. The soil is of low productivity except where manured or fertilized heavily.

WADESBORO LOAM

The surface soil of Wadesboro loam in wooded areas consists of about 1 inch of grayish-brown loam, which carries considerable organic matter, underlain by grayish-brown or slightly reddish-brown loam continuing to a depth of about 8 or 10 inches. Both of these layers are mellow and friable. The subsoil, to a depth ranging from 30 to 40 inches, is dull-red friable crumbly clay which easily breaks into a fine granular mass. It is much more friable than the red clay subsoil of the Tatum soils. This layer grades into the disintegrated red sandstone and shale bedrock which lies in most places at a depth of 4 or 5 feet.

Wadesboro loam occurs in a few small areas in the western part of the county near Albano. Areas are dominantly rolling, although there are some rather steep slopes. Both surface and internal drainage are good. On the more sloping areas, erosion has been active.

The agricultural pursuits on Wadesboro loam are about the same as on Granville loam. Most of the land supports a forest growth of white and post oak, together with a few other hardwoods and a few pines.

Wadesboro loam, eroded phase.—This eroded soil consists of what was originally Wadesboro loam which has been so severely eroded under cultivation that at present the original loam surface soil has been largely removed. The surface soil is clay or clay loam in most places. There is considerable concentration of sandstone and shale fragments on the surface, especially on the ridge tops and steeper slopes.

This soil is mapped in the western part of the county, in association with typical Wadesboro loam. The relief is sharply rolling or hilly. It is essentially waste land, from an agricultural viewpoint, having been denuded of its surface soil covering. Only a small proportion is cleared and in pasture. The soil is best suited to forestry.

LEHIGH SILT LOAM

This soil is called "black land" or "plumbago land." In cultivated fields, it is gray or dark-gray rather stony silt loam 6 or 8 inches deep. The subsoil is fine but friable and smooth yellow clay or silty clay, resting at a depth ranging from 1 to 3 feet on black or dark-colored shale and slate.

Lehigh silt loam occurs only on one long narrow ridge top which passes through Eheart in a northeasterly-southwesterly direction. Areas southwest of Eheart have a loamy surface soil.

This is an inextensive soil and only a small acreage is in cultivation. Fair or low yields of corn, soybeans, and hay are obtained. Some apple trees are grown and produce fairly well. As the land is rather unproductive and shallow, it is suitable only for pasture land and woodland.

WORSHAM SILT LOAM

The surface soil of Worsham silt loam, to a depth of 10 or 12 inches, consists of yellowish-gray friable silt loam containing some faint black streaks of iron stain and some whitish or grayish streaks or mottles which are caused by imperfect or unequal oxidation. The subsoil, which continues to a depth of 36 inches, is pale-yellow and light-gray profusely mottled tough plastic silty clay or clay, resting on schist and shale rocks from which the soil has been derived. This soil has developed under poor drainage conditions and has received, in places, material washed from adjacent higher-lying soils.

Worsham silt loam is very inextensive, being found in small scattered areas near stream heads. Some areas extend along the streams for short distances. The soil occurs in association with Nason silt loam. Areas are nearly flat or gently sloping, and drainage is poor.

The native vegetation consists of white, blackjack, and willow oaks, maples, sycamore, willow, ash, and some pine.

Only a small part of this land is cleared. It is used principally for pasture. Artificial drainage must be provided before it can be used as crop land.

ALTAVISTA SILT LOAM

Altavista silt loam is called "gray bench land." The surface soil is grayish-brown or gray silt loam 10 or 12 inches deep, and the subsoil is yellow friable clay continuing to a depth of 36 or more inches. Included with this soil in mapping are a few small areas of Wickham soils having reddish-yellow subsoils, and a few poorly drained spots on the same terrace level.

Areas are practically flat, lying from about 5 to 8 feet above normal stream overflow. Drainage is fair. Small scattered areas occur along Rapidan and North Anna Rivers, adjacent to the first-bottom lands.

Practically all the land is in cultivation, principally to corn, wheat, soybeans, and cowpeas. Some is grassland. Crop yields are good as a rule.

CONGAREE LOAM

Congaree loam consists of brown friable loam 15 inches deep, underlain by lighter-brown or yellowish-brown heavy loam or silt loam which continues to a depth of 36 or more inches. In places along Rapidan River the surface soil is brown loose fine sandy loam and the subsoil is heavy sandy loam.

Congaree loam occurs in many of the stream bottoms of the county, including that of the Rapidan River. One small gravelly loam area, 3 miles north of Unionville, was included and indicated on the soil

map by gravel symbols. This is one of the most extensive of the bottom-land soils and is subject to overflow.

Most of the land is in cultivation, principally to corn, to which crop it is excellently suited. It also produces fine watermelons and potatoes and other vegetables. Most other cleared areas are in pastures or hay land.

The native vegetation consists of a vigorous stand of sycamore, some ash, elm, birch, water oak, willow oak, willow, and hickory.

CONGAREE SILT LOAM

The surface soil of Congaree silt loam to an average depth of 15 inches consists of brown or reddish-brown friable silt loam. This is underlain to a depth ranging from 30 to 40 inches by heavy silt loam or silty clay loam, which is slightly lighter brown in color. In places, included narrow strips show gray mottles below a depth ranging from 24 to 36 inches. Along the streams flowing out of the Davidson clay loam areas the soil is reddish-brown silty clay loam.

This is the most extensive bottom-land soil in Orange County. It is widely distributed in most of the stream bottoms (pl. 1, B) and is subject to frequent and heavy overflows. Most of it is cleared and produces large annual crops of corn, to which crop it is especially suited. It also supports a good pasture sod. It is naturally one of the most fertile soils in the county. Natural vegetation is similar to that on Congaree loam.

WEHADKEE SILT LOAM

Wehadkee silt loam is the most poorly drained bottom-land soil in Orange County. The surface soil, to a depth ranging from 18 to 24 inches, consists of brownish-gray friable silt loam or silty clay loam containing some mottles of gray and rust brown. This is underlain to a depth ranging from 30 to 40 or more inches by a gray or light-gray silty clay or clay subsoil profusely mottled with rust brown and containing some soft black iron concretionary material.

Areas are flat and drainage is very poor, artificial drainage being necessary to render the soil suitable for general farming. The soil occurs chiefly along upper Pamunky Creek, Mine Run, and in the Flat Run bottoms.

Land of this kind is largely in forest of sycamore, water elm, willow, water oak, willow oak, birch, and similar moisture-loving trees. Some cleared areas, which are included in pastures, have a bunchgrass cover which furnishes good summer pasturage for cattle. On areas which are drained by open ditches some corn is raised.

AGRICULTURE

The chief agricultural soils of Orange County have physical characteristics favorable to agriculture. Among these are good depth, good drainage, and suitable relief. Medium or heavy textures predominate in both surface soils and subsoils, providing good water-holding capacity and drought resistance. The soils are permeable and without subsoil compaction or induration restrictive to the full development of plant roots.

Chemical analyses show that the soils of Orange County are low in nitrogen and lime and rather low in phosphoric acid. They

are comparatively well supplied with potash, especially the heavier soil types. The chemical characteristics are thus rather unfavorable in general. Although a large variety of crops may be grown and diversified agricultural industries carried on, the maintenance of soil fertility requires and will always require careful attention in supplying and replenishing plant-food nutrients by liming, fertilizing, and manuring.

Orange County is not situated in any of the great commercial cash crop belts of the United States, namely the wheat, corn, cotton, and tobacco belts. It is not a region where dairying is highly developed; city markets for whole milk are too far distant. It is not an important beef cattle producing region, being distant from the great fat-cattle markets.

The combination of circumstances is such that the farmers of Orange County find it advantageous to diversify their cropping systems and livestock husbandry. Corn, oats, wheat, and hay are grown on nearly every farm. It is possible to produce dairy and beef cattle economically and to grow and fatten hogs, principally because of the excellence of the pastures. In fact, the outstanding advantage of the agricultural situation is the marked ability of nearly all the soils to produce good pastures and hay crops.

The best grassland soil is Davidson clay loam, which is also the most productive of other crops generally grown. The silt loam soils of the Nason and Tatum series make good pasture lands, when fertility deficiencies are supplied. Iredell loam, a soil not so successfully used for diversified cropping, supports excellent pastures. The loam and sandy loam soils of the county are least suited to the production of grass, being better suited to deeper-rooted crops.

In the early days agriculture in Orange County consisted of the growing of subsistence crops and of tobacco for export to England as a cash crop. Oats, wheat, and corn were grown for food and feed for work animals. Tobacco is mentioned in connection with the earliest white settlement. Before the Civil War, tobacco houses dotted every plantation, and tobacco was the staple cash crop. The Civil War effectively demoralized the agriculture of the county. The important battles of Mine Run and the Wilderness, in 1863 and 1864, were fought in this county. According to present county records the chief hardship to the farmers was the liberation of 3,309 slaves, valued at $1,500,000, or double the value of all other personal property. Impoverishment of the people rather than the destruction of farms resulted from the war. A new start had to be made from extreme poverty.

During the immediate postwar period a transition in agricultural methods began. It resulted in a much better-balanced farming program, marked by increased diversification, with farm animals, poultry products, and fruits supplanting tobacco as sources of cash.

At present, the county is almost wholly an agricultural community, with such small industrial and commercial development as is incident thereto. There are six flour mills operated mainly by water power. At Orange there are a sawmill and a planing mill. Little valuable timber remains in the county. Local woodsmen, in parts of the county, cut and ship considerable pine and oak for excelsior wood and crossties.

United States census reports for Orange County from 1880 to 1925 indicate that corn, wheat, oats, hay, and forage have been the principal crops during this period. The acreage planted to corn consistently exceeded that planted to any other crop until 1919, when the acreage of hay and forage surpassed it. Wheat and oats have been the important small grains during the last 45 years, and very little rye and barley have been produced. Tobacco has been grown on only a small scale since 1885. The large increase in acreage and variety of hay and forage crops, coincident with increases in numbers of livestock and poultry, and the establishment of orchards, mostly of apple trees, on a considerable scale have been the principal changes to the present time.

In 1919, according to census reports, 18,399 acres were in corn, 14,610 acres in wheat, 2,027 acres in oats, and 23,198 acres in hay and forage. In that year timothy alone occupied 915 acres; timothy and clover mixed, 8,109 acres; clover alone, 892 acres; alfalfa, 477 acres; other cultivated grasses, 242 acres; wild grasses, 51 acres; grains cut green, 250 acres; legumes cut for hay, 1,284 acres; silage, 583 acres; and coarse forage, 10,395 acres. Small acreages of rye, potatoes, sweetpotatoes, barley, sorgo, and dry peas are reported. Fruit trees included 51,698 bearing apple trees, 5,384 peach trees, 2,777 pear trees, 554 plum and prune trees, and 1,051 cherry trees. Also 3,192 grapevines, and some small fruits were reported. The value of all crops in that year was $2,335,304.

The 1920 census reports 3,885 horses, 995 mules, and 12 asses or burros, with a total valuation of $503,321. There were 4,346 head of beef cattle, valued at $222,504; 6,399 head of dairy cattle, valued at $388,382; 2,968 sheep, valued at $39,149; 9,643 swine, valued at $117,484; and 76,701 chickens and other poultry, valued at $91,864. The combined value of all domestic animals is given as $1,270,890. Dairy products, excluding those used on the farm, were valued at $231,839; poultry and eggs at $273,401; and wool at $6,999. The total value of all agricultural products in 1919 was $4,118,433.

According to the 1925 census figures available at this time (1927) the acreage in the principal crops in 1924 was considerably less than in 1919. This was owing to inflated land values following the World War, after which came deflation, lower prices, and shortage of farm labor.

The principal cash crops, at present, are wheat, corn, hay, and apples. Cream, butter, beef cattle, calves, and hogs constitute farm products other than crops. Part of the wheat and corn is ground locally into flour and feed and used on the farms. Considerable corn silage is made. The large cities of the Atlantic seaboard receive the farm products marketed outside the county. Some baled hay, principally clover, is shipped. A large proportion of the corn crop, all the oats, and most of the timothy, soybean, cowpea, and alfalfa hay are used as feed for livestock and poultry. Garden and truck crops are produced only for home use.

There are several poultry farms in the county and many general and dairy farmers maintain large flocks of poultry. Many good-sized orchards are seen, but few are on a large commercial scale. Dairying is an important source of income on most farms, the principal dairy product sold being cream.

The character of the land has a marked influence on agriculture. Large hilly areas, notably of Davidson clay loam, hilly phase, are mostly in timber and bluegrass pasture. Even though this is perhaps the strongest agricultural soil of the county, slopes so steep that sheet wash and gullying are rapid under ordinary diversified cropping should be returned to soil-binding crops. Likewise, on many of the other types of soil, the more sharply or abruptly rolling areas, steeper hillsides, and narrow ridges have either been seeded to grass or allowed to revert to forest. Unfortunately, however, the surface soil in many places had been badly washed off by unchecked erosion before preventive measures were adopted.

The range in natural fertility or suitability of soils for sustained crop production is wide, despite the textural similarity of most of the upland soils. The soils recognized as the best general-purpose upland soils are those of the Davidson, Tatum, and Nason series. The Granville soils are recognized as not being inherently productive.

General farming is more or less successful on all the well-drained upland soils, if suitable crop rotations, in which legumes are grown, are used and if lime, manures, and fertilizers are applied in moderate quantities. Soils with poor internal drainage, as Iredell loam, are used largely for pastures or for field crops where drainage conditions allow. Well-drained bottom lands produce excellent corn, which is practically the only crop grown on lands subject to overflow. Poorly drained bottom lands furnish good pasturage.

According to the 1925 census, there are 167,119 acres in farms in Orange County. This is a reduction of 10,036 acres since 1920. Crop land in 1924 totaled 44,904 acres, being subdivided into harvested land 38,013 acres, crop failure 1,439 acres, and fallow or idle land 5,452 acres. The total acreage in pasture land in 1924 was 63,011, of which 52,236 acres were plowable, 6,314 acres woodland, and 4,461 acres other pasture land. There were 53,985 acres of woodland not pastured, and all other land included 5,219 acres.

In 1924, 19.5 per cent of the area of the county was in cultivated crops. Crop land, plus plowable pasture land, embraced 42.3 per cent of the area. In 1919, according to the land classification then in use by the census, 46 per cent of the entire area of the county was improved land in farms. The percentage of the area of the county in farms and the percentage of improved land in farms did not vary appreciably in the 1880 to 1920 period.

In 1919 two-thirds of the farmers in the county reported fertilizer expenditures, totaling $95,365, or $101.67 for each farm reported. The principal fertilizer materials bought are superphosphate (acid phosphate) and complete fertilizers. Some nitrate of soda is used and lime is becoming a considerable item of expense. Stable manure is conserved and spread on the fields, generally on sod before breaking for corn. The periodic use of lime at a rate ranging from 1 to 2 tons to the acre of ground limestone is rapidly becoming general practice. It is customary to use from 200 to 300 pounds to the acre of complete fertilizers ranging in analysis from 3–8–3 [1] to 2–12–2 for wheat. A smaller quantity is used for corn or legumes. Large amounts of superphosphate are purchased and used in connection with liming and manuring, in such a rotation as corn 1 year, wheat

[1] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

1 year, and clover and timothy 2 years. Soybeans or cowpeas are sometimes turned under to supply organic matter.

The farm-labor situation is serious in Orange County and has been so for some years past. The reasons given by the farmers for shortage of labor and high wages demanded include competition with industrial activities in near-by cities, the recent agricultural depression and local competition for labor by large landowners of the wealthier class, a number of whom maintain country estates within the county. Average farm laborers, both negro and white, receive $40 a month with board or its equivalent. Tractor operators, usually white, receive $50 a month with board. The usual day-labor rate is $2.

The average size of Orange County farms in 1920 was 127.1 acres. The 1925 census indicates an increase of 159 farms during the 5-year interval. Several large land holdings were split up, thus causing the increase in number of farms. According to the 1925 census, there were 1,553 farms in Orange County, as compared with 1,394 farms in 1920. In 1925, 1,080 farms were operated by white and 473 by colored farmers. In the same year 1,431 farms were operated by owners, 31 by managers, and 91 by tenants. The percentage of farms operated by owners is unusually high in Orange County. Tenants usually operate farms on a share basis.

According to the 1925 census, the value of farm land and buildings was $7,815,772, as compared with $9,502,510, the corresponding figure for 1920.

On some of the farms, especially those composed of Davidson clay loam, modern farm machinery is in use. This includes tractors, gang plows, harrows, 2-horse seeders or drills, cultivators, mowing machines, hay loaders, and threshing machines, and some silo-filling machinery.

The value of land in 1920 was $34.29 an acre. In 1925 it was $27.56 an acre. Most of the best and highest-priced farms are on Davidson clay loam and are favorably situated with regard to good roads, towns, and shipping points. Farm-land values in the county range from $25 to $125 an acre, depending on type of soil, soil condition, improvements, and distance from towns and transportation lines. Recentlly cut-over timberland commands from $10 to $20 an acre.

As all the soils in the county are acid in reaction, the use of 1 or 2 tons of ground limestone [2] once in four or five years is recommended for the usual farm crops, including pasture grasses.

The best results with the corn crop on upland soils result from first establishing a good 4-year rotation, as corn 1 year, wheat 1 year, and clover and timothy 2 years. All available manure should be applied to the hay crop preceding corn. The best practice is to apply fertilizers to the wheat crop and grass but not directly to the corn. For building up fields of low productiveness, both manure and some commercial fertilizer may be applied directly to corn. On soils derived from sandstone and shale, complete fertilizers should be used. From 300 to 500 pounds of a 2–12–2 fertilizer are recommended. On old sod land or fertile bottom land 200 pounds to the acre of 16 per cent superphosphate is recommended for corn.

[2] Recommendations obtained largely from Bulletin 221, Virginia Agricultural Experiment Station.

The only profitable wheat crops grown in Virginia are fall sown. Commercial fertilizers are usually applied. From 50 to 100 pounds of nitrate of soda applied to young wheat in the spring stimulates growth. From 200 to 400 pounds of superphosphate is the common fertilizer for wheat, applied before seeding in the fall. Large quantities of stable manure are not recommended for wheat as they may cause lodging. A light top-dressing of manure during the winter or early spring is good practice. On less fertile soils, a fertilizer analyzing about 3–10–2 is recommended for wheat, in applications ranging from 200 to 500 pounds to the acre, in connection with lime, manure, and a good rotation. Soybeans or cowpeas may be turned under as a source of organic matter.

On all soil types in Virginia, the best yields of clover and grasses are obtained with the use of phosphatic fertilizers and lime. On the shallow soils, applications of nitrogen and potash or liberal applications of manure are also advisable. It is believed that applications ranging from 300 to 500 pounds of superphosphate and 2 tons of ground limestone to the acre on bluegrass pastures which are beginning to deteriorate will rejuvenate them.

The chief requirements for alfalfa are a well-drained soil in a good state of fertility, a good seed bed and seed, liming, inoculation, and the addition of some phosphatic fertilizer. At least 500 pounds of superphosphate should be applied, and 2 tons of ground limestone to the acre should be used. Plowing under a leguminous crop or applying manure before seeding alfalfa is very desirable, as a much more vigorous stand will result. Best results with alfalfa in Orange County have been obtained on Davidson clay loam.

SOILS

Both the brown and red soil groups of the piedmont plateau are represented in Orange County. All the land in the county, with the exception of narrow strips of first-bottom land and a few small rather flat upland areas, is rolling or hilly and naturally well drained.

The soils of this county are light colored, that is, they range from light gray or grayish yellow to dark red in the surface layers. This light color indicates a low organic-matter content. The soils have developed under a forest cover consisting of deciduous trees such as tuliptree, sycamore, poplar, several oaks, some hickory, walnut, chestnut, and pine. Native grasses of the uplands made a sparse growth and no extensive prairie areas existed. The character of the native vegetation, together with climatic conditions, has not favored the accumulation of a large proportion of organic matter in the soils. Leaves and other débris, under moisture, heat, and acid conditions, have rapidly decayed, leaving only a small amount of organic matter in the first inch or two of the topsoil.

All the soils in Orange County are acid throughout. Calcium, originally present to a greater or less degree in all the rocks, has been leached from the soil to a considerable extent and in no part of the county has it accumulated in the form of carbonate. Such calcium as is present is in some other form than limestone. In Table 9 the pH values of a few of the soil types, determined by means of the H-electrode, are given.

TABLE 9.—*pH determinations of soils in Orange County, Va.*

(1:2 soil-water ratio)

Sample No.	Soil type	Depth	pH	Sample No.	Soil type	Depth	pH
		Inches				*Inches*	
211821	Tatum silt loam	0 to 1	4.17	211836	Tatum sandy loam	12 to 30	4.70
211822	do	1 to 10	4.49	211837	do	30 to 48	4.70
211823	do	10 to 30	4.72	211838	do	48 to 84	4.89
211824	do	30 to 54	4.72	211839	do	84+	4.98
211825	do	54 to 72	4.72	211879	Tatum loam	0 to 10	6.40
211826	do	72+	4.72	211880	do	10 to 30	4.83
211835	Tatum sandy loam	0 to 12	5.12	211881	do	30+	4.83

The soils of Orange County in their profile development bear a direct relation to the parent material or the underlying rocks from which they have been formed. These rocks[3] include Triassic sandstones and shales, Cambrian sandstones and shale, pre-Cambrian granite and granite gneiss, crystalline schist and gneiss, and diabase. In the western end of the county, between Barboursville and Somerset, is an area of Triassic sandstone and shale. These rocks are distinctly different from other formations of the county.

In the granites and schists considerable potassium was present. This has been largely leached from the A horizon, but chemical analyses show that it is abundant in the B horizon. The soils derived from diabase or trap rock have retained more lime than those derived from granites and schist.

The basic rocks, such as diabase and diorite, occur in a broad belt in the northwestern part of the county extending in a southwesterly and northeasterly direction. A belt from 4 to 6 miles in width, of fine-grained crystalline schist, borders the basic formation and occurs as an almost unbroken area through the center of the county from southwest to northeast. In the extreme southern corner a smaller area of coarse-grained light-colored granite is found, and in the southern and eastern parts there are areas of diorite and diabase rocks.

In the disintegration and decomposition of the various rock formations through the natural processes of weathering in this climate, the soil profiles in general have the southern type of coloration; that is, bright red, but some of the soils have brown surface soils, characteristic of soils of the northern piedmont region. The character of the rock, together with climatic influences on the material, has given rise to soils such as those of the Tatum and Nason series, which very closely resemble (in color) the Cecil and Appling soils typically developed in the southern piedmont region.

Most of the upland soils in Orange County are characterized by the light texture of the A horizon and the uniformly heavy texture of the B horizon. In all the soil types except the clay loams, the A horizon consists of two layers, the A_1 horizon in wooded areas commonly being from 1 to 3 inches thick and containing a small proportion of organic matter, and the A_2 horizon being much lighter in color and containing a smaller proportion of organic matter. These soils have an incoherent or slightly coherent consistence, are

[3] Information from the Virginia Gelogic Survey.

porous, and are in general penetrated by rain water. The B horizon of most of the soils of the county is stiff but brittle clay or friable clay, from about 2 to 8 feet in thickness. Extensive areas have a uniform red B horizon in which the color is caused by the complete oxidation of the iron compounds which were present in the original rocks. This uniformly textured, uniformly colored, and thoroughly oxidized thick B horizon indicates that the weathering processes have acted on the rock material for a great length of time and that this layer is of considerable age.

The clay in the B layer is stiff but brittle and is rather easily penetrated by air and water. All the soils of the county are well leached in the A horizon, particularly in the A_2 layer. The organic matter has not only been removed by rain water, but a large amount of the silt and clay has either been moved downward into the B horizon or washed out entirely by the lateral movement of water.

Most of the soils of Orange County, including soils of the Davidson, Tatum, Nason, Penn, Granville, and Wadesboro series, have developed a normal soil profile. Tatum sandy loam probably is the most mature of the normally developed soils of the county. The best-developed profiles are found on the smoother-surfaced areas where good drainage has existed and where erosion has not been pronounced. In these normally developed soils, the A horizon is highly eluviated, the B horizon is distinctly illuviated, and the C horizon, consisting of the partly weathered formations which are varied in characteristics and composition, differs greatly from place to place.

Several of the typical soils and phases of the series mentioned have not developed a normal soil profile owing to destructive erosion, imperfect drainage, or age of the material. Stream cutting has been active, and erosion is noticeable on many of the hills and steeper slopes. In the eroded areas, the washing off of the A horizon and in many places the B horizon has kept close pace with the disintegration and weathering of the rock. This has resulted in the accumulation of a very shallow solum where no definite horizons are developed. Such areas, therefore, represent soil conditions rather than normally developed soils. The early settlers found large areas of tillable land covered with a friable topsoil of plow depth. After two centuries of agricultural activity, which has consisted of general farming under clean cultivation, the original surface soil shows disastrous effects of erosion.

Mature and young soils derived from the same rock occur in many places in close geographic relation. The Davidson and Iredell soils are examples of this condition, as both are derived from diabase or diorite rock. The Davidson are the more mature soils and represent the extreme stage of oxidation and weathering, whereas the Iredell may be considered very young soils. Montalto clay loam is also derived from the basic rocks and differs from Davidson clay loam in that the color of both the A and B horizons is light brown in contrast to the deep red or maroon red of the B horizon of the Davidson soils. Orange silt loam is closely related to Iredell loam in origin, color, and structure, but apparently it represents a further stage in the development of the B horizon. In the Orange soil the

B horizon consists of two parts, a friable layer of uniform color and a layer resembling the typical B horizon of Iredell loam.

The Tatum and Nason are newly established series. The soils are derived from fine-grained crystalline schists or shale and in places from light-colored coarse-grained granite. The influence of these rocks on the soils is great and the granites, which are high in quartz grains, have given rise to a sandy surface soil. The fine-grained schist has given rise to extensive areas of fine-textured soils; that is, extensive areas of soil high in silt are directly traceable to the parent rock.

The Penn, Granville, and Wadesboro soils are derived from Indian-red or purplish sandstones and shales and from light-colored sandstones and shales. These soils are essentially the same in their characteristics as the soils mapped farther north and also farther south in the piedmont plateau. The Indian-red or purplish color of the Penn soils is inherited from the parent rock; that is, the soil is young and leaching has not changed the color. The light-colored rock has produced light-colored and friable soils, the Granville soils.

On the terraces and in the first bottoms are developed the Altavista, Congaree, and Wehadkee soils. These terrace and bottomland soils represent materials which have been washed from the upland and brought down and deposited by the streams. In Altavista silt loam, which occupies terrace positions, some of the soil material has lain above overflow for a sufficient length of time to develop the characteristics of a normal soil profile. The Congaree and Wehadkee soils consist of recently deposited material in the first bottoms. This material is altered by the addition of alluvium at each overflow of the streams or is changed by washing of the streams. It is so young and so poorly drained that no evidence of a definite soil profile is seen.

SUMMARY

Orange County is one of the smaller north-central Virginia counties in the piedmont plateau region. The land is rolling or hilly, elevations ranging from 200 to 1,200 feet above sea level, and drainage is excellent. The frost-free season extends over six and one-third months, and the mean annual precipitation is 43.43 inches.

Approximately 95 per cent of the area of the county consists of upland residual soils, of which the greater part have granular moderately friable clay subsoils and only a small proportion have tough plastic clay subsoils. Approximately 4 per cent of the upland soils have sandy surface soils, 15 per cent are loamy, 45 per cent are silt loam, and 36 per cent are clay loam or clay. Only 5 per cent of the soil in the county is stream alluvium, mostly first-bottom land of dominantly silt loam texture.

Approximately 40 per cent of the area of the county, including tame pastures, is in cultivation, and the remainder is in second-growth timber, principally of hardwoods with some juniper and shortleaf pine.

The soils of Orange County are of the bright-colored southern type. Most of the upland soils are deeply weathered and are residual from a number of distinctive rocks, as diorite, granite, gneiss, schist, sandstone, and shales. There is, accordingly, a wide range

in characteristics of the several soil series, shown in their natural plant-food content, adaptability, and productiveness.

The more important agricultural soils belong to the Davidson, Tatum, and Nason series. The heavier-textured members of these series are the more extensive. Collectively, these soils cover approximately three-fourths of the area of the county. Other upland soils belong to the Iredell, Orange, Montalto, Penn, Granville, Wadesboro, Lehigh, and Worsham series. Altavista silt loam is the only terrace soil mapped. The Congaree and Wehadkee series embrace the first-bottom soils of the county.

The agriculture of Orange County is more like that of the Northeastern States than it is of the Southeastern States. The principal crops are corn, wheat, oats, soybeans, cowpeas, clover and timothy hay, alfalfa, and bluegrass pasture. A considerable acreage is in orchard trees, chiefly apples. Dairying is an important animal industry, and beef cattle, hogs, and poultry are raised, in greater or smaller numbers, on most farms.

Railroad transportation facilities are good, rendering the large outside markets easily accessible. Farm land values range from $25 to $125 an acre.

Considerable areas of agricultural land are not in use at present, either for tame-hay pasture or crop land, but are growing up to native timber. Some of these lands offer attractive opportunities for future agricultural development.

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[PUBLIC RESOLUTION—No. 9]

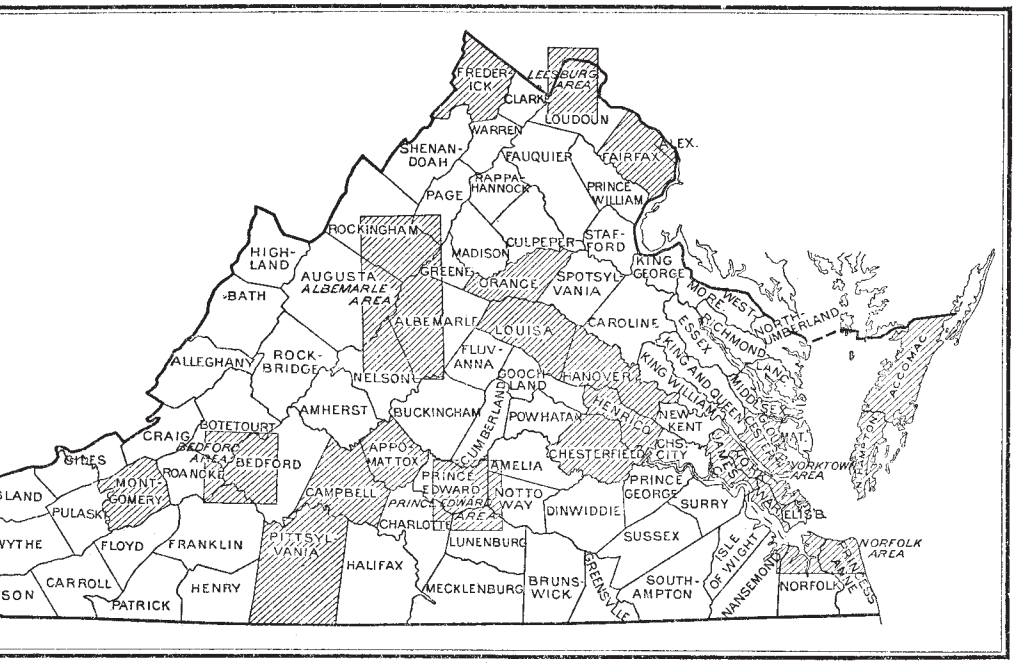
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]



Areas surveyed in Virginia, shown by shading

W. S. GOVERNMENT PRINTING OFFICE: 1920

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U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
HENRY G. KNIGHT, CHIEF
A. G. McCALL, CHIEF, SOIL INVESTIGATIONS
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP

ORANGE COUNTY
VIRGINIA

CONVENTIONAL SIGNS

CULTURE
(Printed in black.)

- City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort
- Secondary roads and Trails
- Railroads, Steam and Electric
- Bridges, Ferry
- R.R. crossings, Tunnel
- Ford, Dam
- School or Church, Cemeteries
- Mine or Quarry, Mine dumps, Made land
- Stony and Gravelly areas
- Boundary lines
- Boundary lines
- Boundary lines
- Bluff, Escarpment, Rock outcrop, and Triangulation station
- Soil boundaries
- Boundary lines
- U.S. township and section lines

DRAINAGE
(Printed in blue)

- Streams
- Intermittent streams
- Swamp, Salt marshes
- Lakes, Ponds, Intermittent lakes
- Springs, Canals and Ditches, Flumes
- Submerged marsh, Tidal flats

RELIEF
(Printed in brown or black)

- Contours, Depression contours
- Sand, Wash, and Sand dunes
- Prominent Hills, Mountain Peaks
- Shore and Low-water line, Sandbar

The above signs are in current use on the soil maps. Variations from this usage appear in some maps of earlier dates.

LEGEND

Altavista silt loam — As	Granville fine sandy loam — Gf	Nason sandy loam — Ny	Tatum loam — Tl
Congaree loam — Cl	Iredell loam — Im	Nason loam — Nl	Tatum silt loam — Ts
Congaree silt loam — Cs	Lehigh silt loam — Ls	Orange silt loam — Os	Tatum clay loam — Tc
Davidson clay loam — Dc	Montalto clay loam — Mc	Penn silt loam — Ps	Wadesboro loam — Wl
Dc — Hilly phase	Nason silt loam — Ns	Penn clay loam — Pc	Wl — Eroded phase
Granville loam — Gl	Ns — Eroded phase	Pc — Hilly phase	Wehadkee silt loam — Wm
Gl — Stony phase	Ns — Steep phase	Tatum sandy loam — Ty	Worsham silt loam — Ws

Scale 1 inch = 1 mile
1 ½ 0 1 2 3 4 Miles

W. Edward Hearn, Inspector, District 2.
Soils surveyed by B. H. Hendrickson.

WILLIAMS & HEINTZ CO. WASH. D.C.

Field Operations
Bureau of Chemistry and Soils
1927